S.6 BIO 2 TEST 2 2022 MARKING SCHEME

1.

a)

i.

Differences

A	B
Below 30 the rate of photosynthesis is higher	Below 30 the rate of photosynthesis is lower
From 20 the rate of photosynthesis increased gradually	From 20 the rate of photosynthesis increased rapidly.
Rate of photosynthesis attained a lower peak of 30 of absorbed carbon dioxide.	Rate of photosynthesis attained a higher peak of 39 of absorbed carbon dioxide.
Attained a peak at a lower temperature of 25/earlier.	Attained a peak at a higher temperature of 40/later
From 25 the rate of photosynthesis decreased gradually	From 25 the rate of photosynthesis increased rapidly
Above 30, the rate of photosynthesis is lower	Above 30, the rate of photosynthesis is higher
From 40 the rate of photosynthesis decreased rapidly	From 40 the rate of photosynthesis decreased slowly/gradually

@1MK, 07MKS

ii)

Similarities

- In both the rate of photosynthesis increased rapidly from 10 to 20;
- Both have same rate of photosynthesis at 30;
- In both the rate of photosynthesis decreased from 40 to 45;
- Both rates of photosynthesis attained peaks;

@1MK

03MAX

b)

i. A-Mediterean/ temperate climate;

B-tropical climate; @1MK, 02MKS

ii. A is found in mediterean/temperate climate; because it has high rate of photosynthesis at low temperature between 20 and 25 at which the rate of photosynthesis is highest. This plant species has enzymes which are active at low temperatures existing in temperatr and when temperature is increased to that found in tropics the enzymes are denatured thus decrease in photosynthetic rate.

B is found in tropical climate; because it has high rate of photosynthesis at high temperature between 40 to 45 at which the rate of photosynthesis is highest. This plant species has enzymes which are active at high temperatures existing in tropics and when temperature is decreased to that found in temperate, the photosynthetic enzymes are inactivated thus decrease in photosynthetic rate.

@0.5MK

07MKS

c)

i. Carbon dioxide concentration in air/water;

Concentration of chlorophyll in leaves;

Number of stomata of each leaf;

Light intensity;

Surface area of a leaf;

Concentration of oxygen in a leaf;

@0.5MK

02MAX

ACC: Any correct 4 given.

ii. Carbon dioxide is a raw material for dark stage reactions of photosynthesis; thus, its rate of absorption is an indicative of rate of photosynthesis;

@01MK

02MKS

d)

Some bubbles may not be seen due to variations in size;

Bubbles may be evolved to fast to be counted; especially in much illumination.

Some may dissolve in water thus couldn't be seen and counted;

@01MK

02MAX

Acc: Any 2 given.

(e)

i. As wave length increased from 420nm to 450nm; the amount of light absorbed by chlorophyll decreased gradually; which resulted into gradual decreased in the rate of photosynthesis;

As wave length increased from 450nm to 550nm; the amount of light absorbed by chlorophyll decreased rapidly; which resulted into rapid decrease in rate of photosynthesis; up to a minimum at 20per min;

As wave length increased from 550nm to 600nm; the amount of light absorbed by chlorophyll increased slowly; but resulted into rapid decrease in rate of photosynthesis;

As wave length increased from 600nm to 660nm; the amount of light absorbed by chlorophyll increased rapidly; which resulted into rapid increase in rate of photosynthesis; up to another maximum at 90per min;

@0.5MK

06MAX

ii. As wave length increased from 420nm to 450nm; the amount of light absorbed by chlorophyll decreased gradually; which resulted into gradual decreased in the rate of photosynthesis; because most light absorbed by chlorophyll; was actively used in photosynthesis;

As wave length increased from 450nm to 550nm; the amount of light absorbed by chlorophyll decreased rapidly; which resulted into rapid decrease in rate of

photosynthesis; because most light was reflected by the leaves; thus, was not used for photosynthesis;

As wave length increased from 550nm to 600nm; the amount of light absorbed by chlorophyll increased slowly; but resulted into rapid increase in rate of photosynthesis; because most light was absorbed by accessory/secondary photosynthetic pigment; and passed over to chlorophyll and utilized in photosynthesis;

As wave length increased from 600nm to 660nm; the amount of light absorbed by chlorophyll increased rapidly; which resulted into rapid increase in rate of photosynthesis; because most light absorbed by chlorophyll; was actively used in photosynthesis;

@0.5MK

09MAX

SECTION : B (60 MARKS)

2. .

- Epithelial tissues are grouped into 3 types, simple epithelial tissues which have one layer of cells, resting on the basement membrane; compound epithelial tissues with many layers of cells; glandular epithelial tissues with secretory glands;

  Simple epithelial tissues

- Squamous epithelial tissue/pavement; has a thin flattened layer of cells; which reduces diffusion distance; across which materials are exchanged like in alveoli/alveolar walls; endothelium/walls of blood vessels, Bowman's capsules and ileum; and smooth for friction free movement of materials like in blood vessels;

- Cuboidal epithelial tissue; has cube-shaped/cuboidal layer of cells; of which some have Golgi vesicles; that carry out secretion of materials; like in ducts such as pancreatic and salivary ducts; cells also have microvilli/brush borders; on their free/apical surfaces/ends which increase the surface area; for absorption like selective reabsorption in tubules of kidney nephrones;

- Columnar epithelial tissue; has narrow, elongated cells; perpendicular to basement membrane of which some have microvilli; that increase surface area for absorption; of materials in ileum;

- Ciliated epithelium; has cells with cilia at free surface; which aid in movement/propelling materials like ovum; in oviduct; and cerebrospinal fluid; in

spinal cord; Aslo trap debris/dust; in tracheae and nosal openings;;

- Pseusostratified epithelium; has single layer of cells; some don't reach free surface; Some have cilia on free surface; others have goblet cells; all cells rest on basement membrane; trap dust/foreign particles from air in tracheae; nasal passages; urethra; urinary tract;

  Compound epithelial tissues

- Stratified epithelium; has many/about 12 layers of cells; one layer of cells rests on basement membrane; cells near basement membrane are cuboidal in shape; cells near free surface are squames/flattened; and dead; thus is tough for protection of internal organs against mechanical damage; like in skin's epidermis; and buttocks; etc

- Transitional epithelium; has 3-4 layers of cells; with stretchable cells; control amount of materials in urinary bladder, vagina, cervix, air/respiratory passages;

- Glandular epithelium; has epithelial cells interspersed with secretory cells like goblet cells and glandular cells forming a multicellular glands;;exocrine glands with ducts like mammary glands, salivary glands; etc endocrine gland without ducts like adrenal gland and pituitary gland; etc. Secrete different secretions in the body like enzymes, hormones ;etc **@0.5MK; 30 MKS; 20 MAX**

3.

a) This is the change of the three dimensional shape of the protein molecule; due to the breaking/breakage of weak ionic and hydrogen bonds;

@01MK, 02MKS

b) **Heat**; increases the kinetic energy; causing the atoms of protein to vibrate more significantly thus breaking of the ionic and hydrogen bonds;

Acids; hydrogen ions/protons from acids combine with carboxyl groups/groups on amino acids and form thus breaking ionic bonds;

Inorganic chemicals; highly electropositive ions like mercury (I) ions, silver ions and highly electronegative ions like cyanide ions combine with amino group/groups and disrupt ionic bonds.

Organic chemicals; organic solvents like detergents alter hydrogen bonds in proteins;

Vigorous agitation/mechanical force; physical movements tend to break hydrogen bonds.

Alkalis; cause amino groups/groups to lose hydrogen ions and form thus breaking ionic bonds. **06 marks 05 MAX**

c) **Support and movement**

Actin/myosin; for muscle contraction; ossein; for structural support in bone; collagen; for strength and flexibility in tendon and cartilage; elastin; for strength and elasticity/flexibility to ligaments; keratin; it is tough for protection like in nails, skin, hooves and scales;

Sclerotin/chitin; for strength in insects' exoskeleton; lipoprotein; for structural composition of cell membrane; mucin; for lubrication; **08 marks**

Respiration and transport

Haemoglobin/haemoerythrin/haemocyanin/ chlorocruorin; for transport of respiratory gases/oxygen;

Myoglobin; for storage of oxygen in muscles; prothrombin/fibrinogen; for blood clotting; mucin; for keeping respiratory surfaces moist; antibodies; for defense of the body against infections; **04 MAX**

4. .

a) This is a plant in which the immediate product of carbon dioxide fixation; is a four-carbon compound oxaloacetic acid/oxaloacetate; **@01MK, 02MKS**

b) .

i. Photosynthesis can proceed at very low carbon dioxide concentration; due to high affinity of PEP carboxylase for carbon dioxide;

Plants can efficiently photosynthesize at high temperatures; as PEP carboxylase is not inhibited by temperature;

Carbon dioxide can be temporarily stored for later use since the four-carbon compound oxaloacetate; can be converted to malate and stored; then later it is broken down to pyruvate; which release carbon dioxide for use in pathway.

Photorespiration is avoided; since it reduces photosynthesis efficiently; this is because PEP carboxylase is not inhibited by oxygen in plants.

@01MK. 07MKS, 06MAX

ii. Carbon dioxide diffuses from atmosphere into palisade mesophyll cells' cytoplasm via stomatal pore; accepted/fixed by phosphoenol pyruvate (PEP); a four-carbon compound a reaction catalysed by PEP carboxylase; to form oxaloacetate; which is reduced by NADP/; to form malate; shunted into bundle sheath chloroplasts; of bundle sheath cells; via plasmodesmata; malate undergoes decarboxylation; to form pyruvate; and carbon dioxide; which enters into the Calvin cycle; and pyruvate passes into mesophyll cells; where it is converted into PEP.

@0.5MK,07MKS,06MAX

(c) .

- Palisade mesophyll cells are well placed on/around the vascular bundles and bundle sheath cells; for absorbing carbon dioxide from adjacent air spaces;
- Bundle sheath cells have chloroplasts for trapping light;
- Phloem is ideally situated for carrying away the abundant products of photosynthesis;
- Mesophyll cells are tightly packed around bundle sheath cells; to prevent carbon dioxide loss;
- Bundle sheath chloroplasts have no/little grana; to minimize oxygen production from photolysis thus photorespiration avoided;

@01MK,08MKS,06MAX

5.

a)

- Is the major organ involved in temperature regulation in the body;
- Provides protection against mechanical damage/ultra violet radiation from the sun/microorganism invasion/ water loss of underlying tissues;
- Is a sense organ, containing sensory nerve endings for detecting temperature, touch, pressure and pain;
- Is an excretory organ of urea, salt and excess water;
- Manufactures vitamin D when exposed to sun light; **@01MK, 05 MKS**

b) .**Aestivation** is the state of dormancy where an organism lowers its metabolic rate,

growth and development suspended to survive adverse hot and dry conditions; like. lung fish encased itself in cocoon during drought;

WHILE

Hibernation is the state of dormancy where the organism lowers its metabolic rate, growth and development suspended in order to survive extremely cold conditions; Like polar bear in winter; **@01MK,04MKS**

c) Temperature regulation is achieved by negative feed back mechanism under the control of thermoregulatory centre within the hypothalamus; with heat loss centre and heat gaining centre; Increase in body temperature beyond the norm; is detected by Ruffini corpuscles/hot thermoreceptors in the skin; which are stimulated to fire sensory/afferent impulses to heat loss centre via afferent neurone; which responds by sending efferent impulses to the liver, skin, muscles via efferent/motor neurons; which result in the following:-

Physical/physiological means

- Vasodilation; superficial capillaries dilate/widen their lumens' diameter; increased blood flow near skin surface; much heat lost by conduction and radiation;
- Sweating increased; by sweat glands; heat lost by evaporation; from skin surface.
- Panting; birds/dogs; heat lost by evaporation from lung, pharynx and other moist body surface.
- Erector pili muscles relax; hair/fur lowered; no insulating layer of air moisture trapped, heat loss encouraged.
- Metabolic rate reduces; heat generation minimized.

Behavioural means

- Taking cold drinks (not advisable);
- Putting on light clothes like vests;
- Migrate to shady places;
- Taking cold bath (not advisable);
- Nocturnality; more active at night.

- Thermodancing;

All these are geared towards lowering body temperature to norm.

Decrease in body temperature below the norm is detected by klause corpuscles/cold thermoreceptors within the skin; stimulated to trigger afferent impulses to heat gaining centre in the thermoregulatory centre via afferent neurones; heat gaining centre responds by firing efferent impulses to skin, liver and muscles via efferent neurons which results into the following responses:-

Physical/physiological means

- Vasoconstriction; superficial capillaries narrow their lumen diameter; blood volume flow near skin surface decreased; heat loss by conduction and radiation minimized;
- Sweating decreases/stops; reduced heat loss by evaporation.
- Erector pilli muscles contract; hair/fur stand, insulating layer of air moisture trapped; heat loss reduced by convection.
- Metabolic rate increased; more heat generated to maintain body temperature especially in muscles and liver cells; brown fats may be metabolized also.
- Shivering; involuntary (rhythmical)contraction of skeletal muscles; heat generated metabolically; gooses formed by smooth muscles;

Behavioural means

- Taking hot drinks (not advisable)
- Putting on heavy clothes like sweaters, jackets etc
- Migration near fire places
- Turning on heat in houses
- Sun bathing/basking
- Huddling decrease surface area

All these responses are geared towards increasing body temperature to norm.

@01MK; 11MAX

6. .

DISTRIBUTION	FUNCTIONS
Cell surface membrane surrounds the protoplasm;	Partial permeability encloses protoplasm ; allows exchange of materials; cell to cell recognition; Reception of chemical signals such as hormones; sticking correct cells together in tissue formation may contain enzymes; energy transducers ,electron carries;
Nuclear membrane bounds the nucleus nucleoplasm;	Outer membrane covered with ribosomes for protein synthesis; inner membrane has adhering point for chromosomes during interphase; nuclear pores allow exchange of materials between nucleus and cytoplasm; allows mRNA out, limits DNA;
Mitochondrial envelope bounds the mitonchondrion;	Outer mitochondrial membrane selectively permeable to chemicals; Inner mitochondrial membrane is site for attachment of components of respiratory chain;
Endoplasmic reticulum runs throughout the cytoplasm as extension of outer nuclear membrane;	Provides large surface area for biochemical reactions pathway for intercellular transport; rER is site for attachment of ribosome; synthesis of proteins, lipids and carbohydrates; storage of lipids and carbohydrates; sER of liver dells contains lytic enzymes;
Chloroplast envelope:	Outer chloroplast envelope allows;
Photosynthetic membranes form thylakoids grana and lamellae found in chloroplasts;	Contain photosynthetic pigment, enzymes and electron can for photosynthesis;
Membranous cisternae and Golgi vesicles of Golgi apparatus;	Sorting ER-synthesized materials; synthesis of glycoprotein, enzymes and polysaccharides of glycoprotein and lipids; forms of lysosomes, transporting lipid;
Single membrane bounds lysosomes;	Limit autolytic enzymes autolysis;

DISTRIBUTION	FUNCTIONS
Tonoplast bounds plant cell vacuoles;	Limits cell sap selectively allowing osmosis in & out of vacuole;
Single membrane bound phagocytic vesicles;	Uptake of bulk solid materials;
Single membrane bounds peroxisomes/ microbodies;	Limit enzymes such as catalase;
Myelin sheath membrane bounds myelinated axons;	Insulation of nerve fibre;

@0.5MK, 20MAX

END